#6

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: Hajime NISHIHARA

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For: AROMATIC POLYCARBONATE RESIN COMPOSITION

Art Unit: 1712

Examiner: David J. Buttner

DECLARATION UNDER 37 C.F.R. 1.132

I, the undersigned, Hajime Nishihara, a Japanese citizen, residing at 1-25-8, Morigaoka, Isogo-ku, Yokohama-shi, Kanagawa-ken, Japan, hereby declare and state that:

I completed Master Course at the Graduate School of Science, Kyoto University in March 1978.

I entered Asahi Kasei Kabushiki Kaisha in April 1978.

Since then, I have been engaged in research on polymer chemistry to date.

I am the applicant of the above-identified application and I am well familiar with the present case.

I have read and understood the Office Action dated February 13, 2002 and the references cited therein.

I carried out Examples 1 to 101 and Comparative Examples 1 to 11 of the present application, and the results are as described on pages 78 to 98 of the specification of the present application.

With reference to Examples 70 to 77 and Comparative Examples 1 to 11 of the present specification, I have made observations to show that the use of the aromatic group-containing linear silicone compound recited in claim 1 of the present application is critical for achieving the excellent effects of the present invention, i.e., the effects that the polycarbonate resin composition obtained by the process of the present invention is advantageous not only in that it has excellent flame retardancy and excellent melt-molding stability, but also in that it can be used for producing a shaped article having excellent mechanical properties, excellent light stability and excellent appearance. The method and results are as described in a paper attached hereto and marked "Exhibit 1".

From the results, it can be fairly concluded:

(1) that, in Examples 70 to 77 (wherein a silicone compound satisfying the definition of the aromatic group-containing linear silicone compound recited in claim 1 is added to an aromatic polycarbonate) (aromatic polycarbonate is hereinafter referred to as "PC"), th evaluation of the flame retardancy is ◎ or ○ , indicating excellent flame retardancy (wherein, as

described in the Notes for Table 1, the symbol ◎ means "self-extinguished within less than 20 seconds" and the symbol ○ means "self-extinguished within 20 to 40 seconds");

(2) that further, in Examples 70 to 77, the Izod impact strength is as high as 10 to 20 kg·cm/cm; the yellowness index ΔYI (yardstick of appearance) is very excellent, specifically as low as 2 to 4; the value of difference in color tone ΔE (yardstick of light resistance) is very excellent, specifically as low as 2 to 3; and the Izod variation percent (yardstick of extrusion stability) is very excellent, specifically as low as 2 to 7 %;

(3) that thus, in Examples 70 to 77, all properties are excellent;

(4) that by contrast, among Comparative Examples 1 to 11, a flame retardancy evaluation of the symbol ○ (excellent) is obtained only in Comparative Examples 4 to 6, wherein PPE is used;

(5) that, in each of Comparative Examples 1 to 3 and 7 to 11, the flame retardancy evaluation is × , indicating very poor flame retardancy (wherein, as described in the Notes for Table 1, the symbol × means "totally burnt" (not self-extinguished));

(6) that further, Comparative Example 1 (wherein only PC is used and no flame retardant is used) exhibits an Izod impact strength of 15 kg·cm/cm, which is relatively high; however, Comparative Examples 2 to 11 exhibit an Izod impact strength as

low as 2 to 8 kg·cm/cm;

(7) that, in Comparative Examples 4 to 6 (wherein PPE is used), the yellowness index ΔYI (yardstick of appearance) is very poor, specifically as high as 43 to 45, and also the value of difference in color tone ΔE (yardstick of light resistance) is very poor, specifically as high as 20 to 25;

(8) that further, in Comparative Example 1 (wherein only PC is used and no flame retardant is used) and in Comparative Example 4 (wherein only PPE is used and no flame retardant is used), the Izod variation percents (yardstick of extrusion stability) are respectively 5 % and 9 %, which are relatively low; however, in Comparative Examples 2, 3 and 5 to 11, the Izod variation percent (yardstick of extrusion stability) is very poor, specifically as high as 18 to 63;

(9) that thus, in any of Comparative Examples 1 to 11, not all properties are excellent and some properties are poor;

(10) that attention is especially drawn to the fact that in any of Comparative Examples 2, 3 and 7 to 11 (wherein PC is used and there is used a silicone compound having a branched or crosslinked configuration or a silicone compound in which the amount of an aromatic group does not satisfy the range recited in claim 1), the flame retardancy evaluation is × (indicating very poor flame retardancy), and the Izod impact strength is as l w as 2 to 8 kg·cm/cm, and the Izod variation percent is very po r, specifically as high as 29 % to 63 %; that is, all these

values obtained in Comparative Examples 2, 3 and 7 to 11 are very poor, as compared to those obtained in Examples 70 to 77;

(11) that as apparent from the above, the use of the aromatic group-containing linear silicone compound recited in claim 1 is critical for achieving the excellent effects of the present invention; and

(12) that as also apparent from the above, the flame retardant used in the present invention (the aromatic group-containing linear silicone compound recited in claim 1) is far superior to a flame retardant comprising a branched or crosslinked silicone compound.

The undersigned petitioner declares that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: ____________________

____
Hajime NISHIHARA

Exhibit 1

Observations, with reference to Examples 70 to 77 and Comparative Examples 1 to 11 of the present specification, to show that the use of the aromatic group-containing linear silicone compound recited in claim 1 of the present application is critical for achieving the excellent effects of the present invention

1. Object:

The object of the observations is to show that the use of the aromatic group-containing linear silicone compound recited in claim 1 of the present application is critical for achieving the excellent effects of the present invention, i.e., the effects that the polycarbonate resin composition obtained by the process of the present invention is advantageous not only in that it has excellent flame retardancy and excellent melt-molding stability, but also in that it can be used for producing a shaped article having excellent mechanical properties, excellent light stability and excellent appearance.

2. Observations:

Examples 70 to 77 and Comparative Examples 1 to 11 of the present specification are, respectively, described at page 82, lines 1 to 12 of the present specification and at page 78, line 15 to page 80, line 4 of the present specification. Specifically,

in accordance with the formulations indicated in Tables 1 and 2 (for Comparative Examples 1 to 11) or in Table 8 (for Examples 70 to 77) (Tables 1 and 2 are present on pages 86 and 88 and Table 8 is present on page 94), the components were mixed with each other by means of a Henschel mixer. Each of the resultant mixtures was individually transferred into a twin-screw extruder, and a continuous melt-extrusion was conducted at 280 °C for 10 hours, thereby obtaining a resin composition. The obtained composition was subjected to an injection molding under conditions wherein the cylinder temperature was 270 °C and the mold temperature was 60 °C, to thereby obtain shaped articles. The obtained shaped articles were subjected to testings for evaluating the above-mentioned properties. The results of Comparative Examples 1 to 11 are shown in Tables 1 and 2. The results of Examples 70 to 77 are shown in Table 8.

For easy reference, Tables 1, 2 and 8 are reproduced below.

Table 1

		Examples		Comparative Examples					
		1	2	1	2	3	4	5	6
Composition (weight ratio)	(A) PC	92		100	92		0	0	
	(B) Amount	8		0	8		0	8	8
	D units/T units (molar ratio)[1]	100/0		-	100/0	50/50	-	100/0	50/50
	Phenyl groups/ Methyl groups (molar ratio)	25/75	5/95	-	3/97	25/75	-	25/75	25/75
	Presence or absence of methoxy groups in which R^3 or R^4 is a methyl group	None							
	Kinematic viscosity (cSt)	500							
	PPE	-					100	92	
Flame retardancy[2]		◎	◎	×	×	×	○	○	○
Izod impact strength (kg・cm/cm)		15	12	15	7	5	7	5	3
Appearance: Yellowness index ΔYI		2	2	3	3	3	43	44	45
Light resistance: Difference in color tone ΔE		2	2	3	3	5	20	22	25
Extrusion stability: Izod variation percent		5	7	5	29	33	9	18	40

Notes for Table 1

1) Structure of D unit:

$$-O-\underset{\displaystyle R}{\overset{\displaystyle R}{Si}}-O-$$

Structure of T unit:

$$-O-\underset{\displaystyle O-}{\overset{\displaystyle R}{Si}}-O-$$

2) Flame retardancy: ◎ self-extinguished within less than 20 seconds,

○ self-extinguished within 20 to 40 seconds, and

× totally burnt.

Notes 1) and 2) above apply also to Tables 2 to 10 below.

Table 2

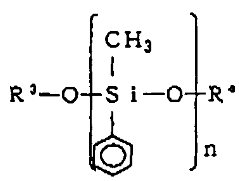
		Examples							Comparative Examples				
		3	4	5	6	7	8	9	7	8	9	10	11
Composition (weight ratio)	(A) PC	90											
	(B) Amount	10											
	D units/T units (molar ratio)[1]	100/0							100/0	0/100	10/90	50/50	80/20
	Phenyl groups/ Methyl groups (molar ratio)	10/90	40/60	60/40	70/30	90/10	100/0	60/40	0/100	60/40			
	Presence or absence of methoxy groups in which R^3 or R^4 is a methyl group	None						Present	None				
	Kinematic viscosity (cSt)	500											
Flame retardancy[2]		○	◎	◎	◎	○	○	◎	×	×	×	×	×
Izod impact strength (kg・cm/cm)		10	12	13	14	16	18	12	2	3	4	6	8
Appearance: Yellowness index ΔYI		2	2	2	3	3	3	2	2	3	3	3	5
Light resistance: Difference in color tone ΔE		2	2	2	3	3	3	2	2	4	4	5	6
Extrusion stability: Izod variation percent		7	5	5	5	4	4	4	55	63	43	35	31

Table 8

		Examples							
		70	71	72	73	74	75	76	77
Composition (weight ratio)	(A) Amount	90							
		PC							
	(B) Amount	10							
	D units/T units (molar ratio)[1]	100/0							
	R^3 and R^4 (see 3) and 4))	R^3=H R^4=H	R^3=$Si(CH_3)_3$ R^4=$Si(CH_3)_3$	R^3=$Si(CH_3)_3$ R^4=H	R^3=$Si(CH_3)_3$ R^4=CH_3	R^3=$Si(Ph)_2CH_3$ R^4=$Si(Ph)_2CH_3$	R^3=$Si(Ph)_2CH_3$ R^4=$Si(Ph)_2CH_3$	R^3=$Si(Ph)(CH_3)_2$ R^4=$Si(Ph)_2CH_3$	R^3=$Si(Ph)_3$ R^4=$Si(Ph)_3$
	n	1	1	1	1	1	3	1	1
	Kinematic viscosity (cSt)	500							
Flame retardancy[2]		○	◎	○	○	◎	◎	◎	◎
Izod impact strength (kg · cm/cm)		10	13	15	14	18	20	17	18
Appearance: Yellowness index ΔYI		2	2	2	2	3	4	4	3
Light resistance: Difference in color tone ΔE		2	2	2	2	3	3	3	3
Extrusion stability: Izod variation percent		7	4	5	3	3	2	2	2
Heat stability: Izod retention percent		81	91	85	93	95	97	97	96

Notes for Table 8

3) Structure of component (B):



4) Ph means a phenyl group.

Notes 3) and 4) above apply also to Table 9 below.

The above-reproduced Tables 1, 2 and 8 refer to D unit and T unit. With respect to the relationship between D unit and T unit and the structure of a silicone compound, the following should be noted. As described at page 39, line 19 to page 40, line 20 of the present specification, a silicone compound comprised only of **D units** (bifunctional) has a **linear** or cyclic structure. On the other hand, a silicone compound comprised only of **T units** (trifunctional) or comprised of both **T units and D units** has a **branched** or **crosslinked** structure.

For easy understanding of the data shown in the above-reproduced Tables 1, 2 and 8, the data concerning the type of the organic polymer resin, the structure of the flame retardant (silicone compound) and the amount of an aromatic group is collected from these tables and shown in Table A below. (In each of Comparative Examples 1 and 4, a silicone compound was not used, and only aromatic polycarbonate or only polyphenylene ether was used.)

Table A

	Organic polymer resin	Flame retardant (silicone compound)	
		Structure	Amount of aromatic group
Example 70	PC	linear	25 mole %
Example 71	PC	linear	25 mole %
Example 72	PC	linear	25 mole %
Example 73	PC	linear	25 mole %
Example 74	PC	linear	75 mole %
Example 75	PC	linear	60 mole %
Example 76	PC	linear	75 mole %
Example 77	PC	linear	75 mole %
Comparative Example 1	PC	-	-
Comparative Example 2	PC	linear or cyclic	3 mole %
Comparative Example 3	PC	*branched or crosslinked* (D units/T units molar ratio: 50/50)	25 mole %
Comparative Example 4	PPE	-	-
Comparative Example 5	PPE	linear or cyclic	25 mole %
Comparative Example 6	PPE	*branched or crosslinked* (D units/T units molar ratio: 50/50)	25 mole %
Comparative Example 7	PC	linear or cyclic	*0 mole %*
Comparative Example 8	PC	*branched or crosslinked* (D units/T units molar ratio: 0/100)	60 mole %
Comparative Example 9	PC	*branched or crosslinked* (D units/T units molar ratio: 10/90)	60 mole %
Comparative Example 10	PC	*branched or crosslinked* (D units/T units molar ratio: 50/50)	60 mole %
Comparative Example 11	PC	*branched or crosslinked* (D units/T units molar ratio: 80/20)	60 mole %

Note: "PC" means aromatic polycarbonate.
"PPE" m ans polyphenylene ether.

As seen in the above-reproduced Table 8 and in Table A above, the flame retardant ("(B)" component) used in each of **Examples 70 to 77** is a silicone compound which satisfies the definition of the aromatic group-containing **linear** silicone compound recited in claim 1. Specifically, the flame retardant ("(B)" component) used in each of Examples 70 to 77 is comprised only of D units (bifunctional) and has a linear configuration and contains an aromatic group in an amount falling in the range recited in claim 1 of the present application (i.e., 5 to 100 mole %, based on the total molar amount of R^1, R^2, R^3 and R^4).

On the other hand, as seen in the above-reproduced Tables 1 and 2 and in Table A above, **Comparative Examples 1 and 4 do not** use a flame retardant (silicone compound as "(B)" component). Further, **Comparative Example 5** uses a flame retardant (silicone compound as "(B)" component) satisfying the definition of the aromatic group-containing silicone compound recited in claim 1, but the organic polymer resin used in Comparative Example 5 is PPE. Further, the flame retardant ("(B)" component) used in each of **Comparative Examples 2, 3, 6 to 11** is a silicone compound which does **not** satisfy the definition of the aromatic group-containing linear silicone compound recited in claim 1. Specifically, the flame retardant ("(B)" component) used in each of Comparative Examples 2, 3, 6 to 11 is a silicone compound having a **branched or crosslinked** configuration or a silicone compound in which the amount of an aromatic group does **not** satisfy the

range recited in claim 1. For example, the flame retardant ("(B)" component) used in Comparative Example 3 contains an aromatic group in an amount of 25 mole % (satisfying the range of 5 to 100 mole % recited in claim 1), but has T units (trifunctional) in addition to D units (bifunctional) and hence **has a branched or crosslinked configuration**. On the other hand, the flame retardant ("(B)" component) used in Comparative Example 2 is comprised only of D units (bifunctional) and hence has a linear or cyclic configuration, but **the amount of an aromatic group is 3 mole %, which does not satisfy the range of 5 to 100 mole % recited in claim 1**. Likewise, the flame retardant ("(B)" component) used in Comparative Example 7 is comprised only of D units (bifunctional) and hence has a linear or cyclic configuration, but **the amount of an aromatic group is 0 mole %, which does not satisfy the range of 5 to 100 mole % recited in claim 1.**

As described below, the results of Examples 70 to 77 and Comparative Examples 1 to 11 clearly show the excellent effects of the present invention. For easy understanding, Table B is shown below, in which the data of the results of the property evaluation (collected from Tables 1, 2 and 8) is combined with the contents of Table A above.

Table B

	Organic polymer resin	Flame retardant (silicone compound)		Evaluation items				
		Structure	Amount of aromatic group	Flame retardancy	Izod impact strength (kg·cm/cm)	Appearance: Yellowness index ΔYI	Light resistance: Difference in color tone ΔE	Extrusion stability: Izod variation percent
Example 70	PC	linear	25 mole %	○	10	2	2	7
Example 71	PC	linear	25 mole %	◎	13	2	2	4
Example 72	PC	linear	25 mole %	○	15	2	2	5
Example 73	PC	linear	25 mole %	○	14	2	2	3
Example 74	PC	linear	75 mole %	◎	18	3	3	3
Example 75	PC	linear	60 mole %	◎	20	4	3	2
Example 76	PC	linear	75 mole %	◎	17	4	3	2
Example 77	PC	linear	75 mole %	◎	18	3	3	2
Comparative Example 1	PC	-	-	×	15	3	3	5
Comparative Example 2	PC	linear or cyclic	*3 mole %*	×	7	3	3	29
Comparative Example 3	PC	*branched or crosslinked* (D units/T units molar ratio: 50/50)	25 mole %	×	5	3	5	33
Comparative Example 4	PPE	-	-	○	7	43	20	9
Comparative Example 5	*PPE*	linear or cyclic	25 mole %	○	5	44	22	18
Comparative Example 6	*PPE*	*branched or crosslinked* (D units/T units molar ratio: 50/50)	25 mole %	○	3	45	25	40
Comparative Example 7	PC	linear or cyclic	*0 mole %*	×	2	2	2	55
Comparative Example 8	PC	*branched or crosslinked* (D units/T units molar ratio: 0/100)	60 mole %	×	3	3	4	63
Comparative Example 9	PC	*branched or crosslinked* (D units/T units molar ratio: 10/90)	60 mole %	×	4	3	4	43
Comparative Example 10	PC	*branched or crosslinked* (D units/T units molar ratio: 50/50)	60 mole %	×	6	3	5	35
Comparative Example 11	PC	*branched or crosslinked* (D units/T units molar ratio: 80/20)	60 mole %	×	8	5	6	31

Note: "PC" means aromatic polycarbonate. "PPE" means polyphenylene ether.

In Examples 70 to 77, the evaluation of the flame retardancy is ◎ or ○ , indicating excellent flame retardancy (wherein, as described in the Notes for Table 1, the symbol ◎ means "self-extinguished within less than 20 seconds" and the symbol ○ means "self-extinguished within 20 to 40 seconds"). Further, in Examples 70 to 77, the Izod impact strength is as high as 10 to 20 kg·cm/cm; the yellowness index ΔYI (yardstick of appearance) is very excellent, specifically as low as 2 to 4; the value of difference in color tone ΔE (yardstick of light resistance) is very excellent, specifically as low as 2 to 3; and the Izod variation percent (yardstick of extrusion stability) is very excellent, specifically as low as 2 to 7 %.

Thus, in Examples 70 to 77, all properties are excellent.

By contrast, among Comparative Examples 1 to 11, a flame retardancy evaluation of the symbol ○ (excellent) is obtained only in Comparative Examples 4 to 6, wherein PPE is used. In each of Comparative Examples 1 to 3 and 7 to 11, the flame retardancy evaluation is × , indicating very poor flame retardancy (wherein, as described in the Notes for Table 1, the symbol × means "totally burnt" (not self-extinguished)). Further, Comparative Example 1 (wherein only PC is used and no flame retardant is used) exhibits an Izod impact strength of 15 kg·cm/cm, which is relatively high; however, Comparative Examples 2 to 11 exhibit an Izod impact strength as low as 2 to 8 kg·cm/cm. In Comparativ Examples 4 to 6 (wherein PPE is used), the yellow-

ness index ΔYI (yardstick of appearance) is very poor, specifically as high as 43 to 45, and also the value of difference in color tone ΔE (yardstick of light resistance) is very poor, specifically as high as 20 to 25. Further, in Comparative Example 1 (wherein only PC is used and no flame retardant is used) and in Comparative Example 4 (wherein only PPE is used and no flame retardant is used), the Izod variation percents (yardstick of extrusion stability) are respectively 5 % and 9 %, which are relatively low; however, in Comparative Examples 2, 3 and 5 to 11, the Izod variation percent (yardstick of extrusion stability) is very poor, specifically as high as 18 to 63.

Thus, in any of Comparative Examples 1 to 11, not all properties are excellent and some properties are poor.

Attention is especially drawn to the fact that in any of Comparative Examples 2, 3 and 7 to 11 (wherein PC is used and there is used a silicone compound having a branched or crosslinked configuration or a silicone compound in which the amount of an aromatic group does not satisfy the range recited in claim 1), the flame retardancy evaluation is × (indicating very poor flame retardancy), and the Izod impact strength is as low as 2 to 8 kg·cm/cm, and the Izod variation percent is very poor, specifically as high as 29 % to 63 %. That is, all these values obtained in Comparative Examples 2, 3 and 7 to 11 are very poor, as compared to those obtained in Examples 70 to 77.

3. Conclusion:

Therefore, the data of Examples 70 to 77 and Comparative Examples 2, 3 and 7 to 11 of the present specification clearly shows that the use of the aromatic group-containing linear silicone compound recited in claim 1 is critical for achieving the excellent effects of the present invention (i.e., the effects that the polycarbonate resin composition obtained by the process of the present invention is advantageous not only in that it has excellent flame retardancy and excellent melt-molding stability, but also in that it can be used for producing a shaped article having excellent mechanical properties, excellent light stability and excellent appearance.).

Meanwhile, attention is also drawn to the fact that in Comparative **Example** 5 (wherein the aromatic group-containing silicone compound recited in claim 1 is added to **PPE**), the flame retardancy evaluation is ○ (excellent); **however**, the Izod impact strength is **as low as 5 kg·cm/cm**, and the yellowness index ΔYI (yardstick of appearance) is **very poor, specifically as high as 44**, and the value of difference in color tone ΔE (yardstick of light resistance) is **very poor, specifically as high as 22**, and the Izod variation percent is **very poor, specifically as high as 18 %**. That is, **all these values obtained in Comparative Example 5 are very poor, as compared to those obtained in Examples 70 to 77**.

Th refor , the data of Examples 70 to 77 and Comparative

Example 5 of the present specification clearly shows that the excellent effects of the present invention (wherein the aromatic group-containing silicone compound recited in claim 1 is added to aromatic polycarbonate) cannot be obtained by adding the aromatic group-containing silicone compound to a resin (such as PPE) other than an aromatic polycarbonate.

As apparent from the above, the use of the aromatic group-containing linear silicone compound recited in claim 1 is critical for achieving the excellent effects of the present invention.

As also apparent from the above, the flame retardant used in the present invention (the aromatic group-containing linear silicone compound recited in claim 1) is far superior to a flame retardant comprising a branched or crosslinked silicone compound.

Exhibit 2

DECLARATION OF TRANSLATOR

I, Kenji KABUKI, c/o the Inoue & Associates of 3rd Floor, Akasaka Habitation Building, 3-5, Akasaka 1-chome, Minato-ku, Tokyo, Japan do solemnly and sincerely declare that I am well acquainted with the Japanese and English languages and that the attached text is a true partial English translation of "Kagaku Daijiten (Encyclopedia Chimica)" Vol. 3, page 317, edited by the Committee for the Edition of Encyclopedia Chimica, Japan, and published by Kyoritsu Shuppan, Co., Japan.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

June 13, 2002
(Date)

Kenji Kabuki
Kenji KABUKI

(Exhibit 2)

Partial English translation of
"Kagaku Daijiten (Encyclopedia Chimica)" Vol. 3,
page 317 (Exhibit 2)

(1) Cover

Kagaku Daijiten (Encyclopedia Chimica)

Edited by the Committee for the Edition of
Encyclopedia Chimica

Vol. 3

Kyoritsu Shuppan, Co.

(2) Page 317, right-hand column, lines 7 to 5 from the bottom

For measuring impurities contained in high purity metallic silicon (for use as a semiconductor), the Hall effect is employed.

(3) Colophon

Kagaku Daijiten (Encyclopedia Chimica) Vol. 3

September 30, 1960 first edition, first printing

September 15, 1963 reduced size edition, first printing

June 1, 1993 reduced size edition, 34th printing

Editor : The Committee for the Edition of Encyclopedia Chimica

Publisher : Masao Nanjo

Printer : Masamitsu Mizuno

Published by Kyoritsu Shuppan Co.

6-19, Kohinata 4-chome, Bunkyo-ku, Tokyo

Exhibit 2

化学大辞典

化学大辞典編集委員会編

3

ENCYCLOPAEDIA
CHIMICA

ク ケ コ サ

共立出版株式会社

.この間を満たす白色の緻セ
美しいケイ石．チャート部は
から成り，それにわずかのセ
ものは赤色を示して赤白ケイ
カロースのような外観をして
かのリョクデイ石を含むもの
石といわれる．鉱床は古生層
キ化され，特殊の熱水作用に
ものと考えられている．丹波
石などはその例で，外国では
利用されていない．なお炉材
色のものも白ケイ石とよんで
(西沢孝治)

珪石煉瓦 〔英silica brick
酸化ケイ素を主体とする耐火
イギリスで製造されたのが起
成生鉱物はクリストバル石．
，残存セキエイ，マトリック
ス)を含む．成分 SiO_2 92～
CaO 1～3%．製法 ケイ石
料にはセキエイからクリスト
すい，やや不純な組成である
成る赤白ケイ石または青白ケ
が普通である．ケイ石を粉砕
合し，結合材として少量の石
才を加えて成形，焼成する．焼
ストバル石へ変化する．最高
粋な白ケイ石を使用し，これ
への変化が困難であるから．
る方法も行なわれるようにな
的には酸性が強いが，ボー皮
マグネシアに対してはアルミナー
り侵食されにくい．またボー
として漸進的軟化現象が少な
荷重軟化点が高い．耐火度は
るが，荷重軟化点(→ 荷重軟
ぐらいある．使用中の軟化収
．以上の性質により天井レン
ものである．また気密性のた
して適する．なお，シャモッ
!合して製造した半ケイ石レン
レンガにケイ石レンガの特徴
.たものである． (山口治郎)

珪線石，シリマナイト 〔英
Sillimanite〕 アルミニウム
B. Silliman の名にちなんで
状 1) ウンモ片岩，片麻岩
イト中 3) 花コウ岩の接触変
産地 香川県綾歌郡長炭村猫
古州郡兵白面上八洞など．組
分析値 SiO_2 41.96, Al_2O_3
22，シャク減 1.72%(猫山
石，ランショウ石と多形であ
斜方晶系．$a:b:c$=0.980
群 Pbnm. a_0 7.43, b_0 7.58,
c_0 5.74 Å．単位格子中の化学式数 4．柱状，針状晶の平行集合体．物理的性質 カタサ 7.5．d 3.23～3.24．無色帯黄色，帯緑色．光学性：二軸性，正．$X=a$, $Y=b$, $Z=c$. $2V$ 30～25°．N_X 1.655～1.661, N_Y 1.658～1.670, N_Z 1.677～1.684, N_Z-N_X 0.020～0.023. $r>v$，強．多色性，X 淡いカッ色，Y 灰緑色，Z 青色．用途 耐火材料． (下田 右)

けいせんせきたい 珪線石帯 〔英sillimanite zone 独Sillimanitzone〕 → 結晶片岩

けいそ 珪素．シリコン 〔英silicon 独Silicium〕 Si．原子番号 14，原子量 28.09．同位体の質量数(崩壊形式，存在比) 26(不確定)，27(β^+)，28(92.18%)，29(4.71%)，30(3.12%)，31(β^-, γ)，32(β^-)．ケイ酸塩は化合物としては古くから知られていたが，元素状(不純)に得られたのは 1823 年 J. J. Berzelius がフッ化ケイ素をカリウムで還元したのが初めである．存在 天然に遊離で産出することはないが，酸化物，ケイ酸塩としては地球上および宇宙間に広く存在し，岩石圏*の主要構成成分である．クラーク数：25.8 (酸素に次ぎ第 2 位)．水圏*にはコロイドケイ酸などとして分布している．また生物体にとっても必要なものとされている．製法 ケイ素をつくるには天然産のケイ砂(ほぼ純粋に近い二酸化ケイ素)を原料とする．これを電気炉中で炭素で還元する．またマグネシウム，アルミニウム (この方法をタッカー法，英Tucker process とよぶ)で還元することもある．結晶形のものを得るにはヘキサフルオロケイ酸カリウムをアルミニウム，ナトリウム，カリウムなどで還元する(→ ケイ素の工業的製法)．精製法 市販品は 96～98% の純度で，不純物は Fe, Al, Mg, Ti, C などである．不純な製品を塩酸，フッ化水素酸で順に洗うと炭化ケイ素以外の不純物はほぼ完全に除かれる．ごく純粋なものをつくるには蒸留精製した四塩化ケイ素，または四ヨウ化ケイ素を高純度亜鉛で高温で還元する：

$$SiCl_4 + 2\,Zn \longrightarrow 2\,ZnCl_2 + Si$$

この方法(デュポン法，英Du Pont process とよぶ) によると，未反応原料および副生した塩化亜鉛は揮発し去り，純粋なケイ素を残す．このようにして得た純ケイ素を帯状溶融法*により，一方の端からごくゆっくり単結晶を成長させると，不純物は他端に集まり，きわめて純粋なものが得られる．構造 暗青黒色の結晶はダイヤモンド型構造*で，板状に成長して変形した正八面体を示すことが多い．格子定数 a 5.42 Å．無定形のカッ色のものの物理的性質はほぼ結晶のものに等しいが，化学的にやや活発である．物理的性質 結晶性のものはかたく，もろい．融点 1414°，沸点 2335°．モースカタサ 7．d^{18} 2.33 (結晶)，2.35 (無定形)．線膨張率 0.0000076$3\,deg^{-1}$(40°)．比熱 0.183 cal/deg·g．n 3.35．誘電率 11.9．ゲルマニウムとともに典型的な半導体*で，充満帯*と伝導帯(→ エネルギー帯)のエネルギー差は 1.12 eV．3 価(たとえばホウ素)または 5 価(たとえばアンチモン)の不純物を微量含むと，それぞれ異常および正常半導体となり，不純物準位*と充満帯(または伝導帯)とのエネルギー差は 0.06～0.08 eV 程度となる．化学的性質 空気中では常温で安定であるが，400° 以上で酸素と，1000° 以上では窒素と反応して，酸化ケイ素，窒化ケイ素を生ずる．ハロゲンとは反応しやすくフッ素(常温)，塩素(430°)，臭素(500°)とそれぞれ四フッ化ケイ素，四塩化ケイ素，四臭化ケイ素を生ずる．電気炉で高温に熱すると炭素，ホウ素などと直接に化合する．通常の無機酸に対しては安定であるが，王水には徐々に侵されるほか，フッ化水素酸と硝酸の混合物には容易に侵される．水酸化アルカリ溶液にあうと水素を発生し，メタケイ酸イオンを生ずる：

$$Si + 2\,OH^- + H_2O = SiO_3^{2-} + 2\,H_2$$

金属ナトリウムおよびハロゲン化アルキルを作用させると，有機ケイ素化合物を生ずる．ケイ素酸素間の鎖状結合をもった有機ケイ素化合物はシリコーン，シロキサンなどとよばれる(→ シリコーン)．分析法 ケイ素は二酸化ケイ素 SiO_2 の形でヒョウ量し，重量法で定量できる．ケイ酸塩を酸で加水分解してつくった含水無水ケイ酸を焼くと，不純物を含んだものとなるので，これをフッ化水素酸と硫酸，またはフッ化水素酸と硝酸で処理し，ケイ素を SiF_4 として揮発させて前後の重量差を SiO_2 とするのがよい．微量のケイ素はケイ酸の水溶液の形で，モリブデン酸アンモニウムを作用させて，ケイモリブデン酸(黄色)の形として比色するか，あるいはこれに塩化スズ(II)を作用させて生ずるモリブデンブルーを比色する．鉄鋼または非鉄金属(特にアルミニウム合金)の中に含まれるケイ素は発光分光分析で定量する．用いられる分析線*は表のとおりである．放射化分析*：$^{30}Si(n,\gamma)$

波 長 (Å)	妨 害 元 素
2881.6 I	Ir, Sb I, Ti II, V II, W
2516.1 I	Pt I
2506.9 I	Co II
2528.5 I	Co I, Co II, Fe I, Sb I, V
2514.3 I	Ir, Os I
2524.1 I	Co II, Fe II, Fe I, Ti II

反応を用いる．存在度 3.05%，生まれる核種の半減期 2.62 時間，放射化断面積 0.0034 バーン，感度 0.3 μg．高純度金属ケイ素(半導体に用いられる)の不純物測定にはホール効果*が利用される．有機化合物中のケイ素は，有機化合物を酸化してケイ素を二酸化ケイ素に変え，これをヒョウ量して定量する．この場合は，試料を灰分分析法に従い，硫酸の代わりに硝酸を用いて焼けばよい(→ ケイ酸イオンの分析法，

化学大辞典 3

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(5) Exhibit 3

Exhibit 3

DECLARATION OF TRANSLATOR

I, Kenji KABUKI, c/o the Inoue & Associates of 3rd Floor, Akasaka Habitation Building, 3-5, Akasaka 1-chome, Minato-ku, Tokyo, Japan do solemnly and sincerely declare that I am well acquainted with the Japanese and English languages and that the attached text is a true English translation of Japanese Patent Application Laid-Open Specification No. Hei 9-87504 (J09087504 patent).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

June 13, 2002	Kenji Kabuki
(Date)	Kenji KABUKI

Exhibit 3

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(74) Agent: Patent attorney Sumihiro MAEDA

(54) Title of the invention: Polycarbonate resin composition

(57) [Abstract]:

[Task] It is a task of the present invention to provide a

polycarbonate resin composition having excellent sliding properties without a sacrifice of impairing good transparency which a polycarbonate resin inherently possesses.

[Means for solving the Task] A polycarbonate resin composition comprising: (A) 95.0 to 99.9 % by weight of a polycarbonate resin, (B) 0.1 to 5.0 % by weight of a phenyl group-containing silicone oil having a refractive index (nd) of 1.42 to 1.58, wherein the total amount of components (A) and (B) is 100 % by weight, and (C) 1 to 10 parts by weight, relative to 100 parts by weight of the total amount of the components (A) and (B), of polycaprolactone.

[Scope of Claims for Patent]

[Claim 1] A polycarbonate resin composition comprising:

(A) 95.0 to 99.9 % by weight of a polycarbonate resin,

(B) 0.1 to 5.0 % by weight of a phenyl group-containing silicone oil having a refractive index (nd) of 1.42 to 1.58,

wherein the total amount of components (A) and (B) is 100 % by weight, and

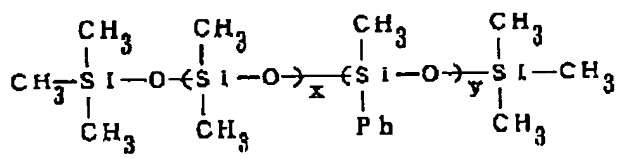
(C) 1 to 10 parts by weight, relative to 100 parts by weight of the total amount of the components (A) and (B), of polycaprolactone.

[Claim 2] The polycarbonate resin composition according to claim 1, wherein the molecular weight of said polycarbonate resin (A) is 10,000 to 40,000 in terms of the viscosity average

molecular weight.

[Claim 3] The polycarbonate resin composition according to claim 1 or 2, wherein said phenyl group-containing silicone oil (B) is at least one member selected from the group consisting of phenyl group-containing silicone oils represented by following formulaa (1) to (4):

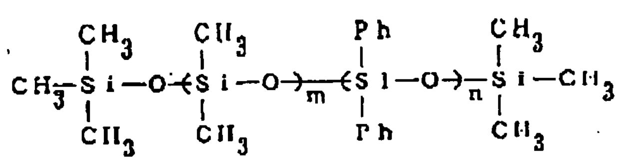
[Chemical formula 1]



(1)

wherein Ph represents a phenyl group, and x and y are integers, wherein $0 \leq x \leq 100$ and $0 \leq y \leq 100$,

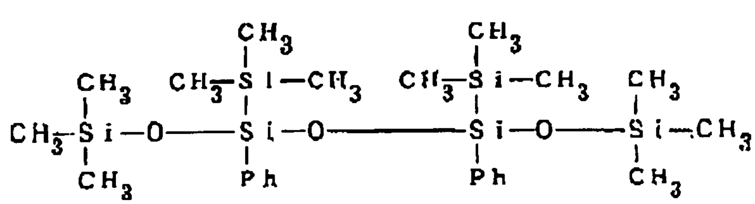
[Chemical formula 2]



(2)

wherein Ph represents a phenyl group, and m and n are integers, wherein $0 \leq m \leq 100$ and $0 \leq n \leq 100$,

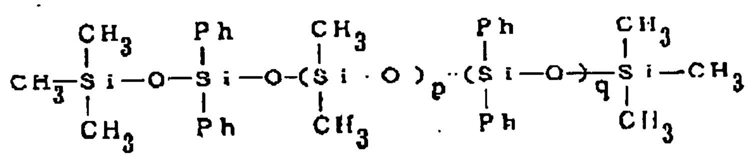
[Chemical formula 3]



(3)

wherein Ph represents a phenyl group, and

[Chemical formula 4]



(4)

wherein Ph represents a phenyl group, and p and q are values such that the phenyl group content of the phenyl group containing silicone oil represented by formula (4) is from 7 to 80 wt %.

[Claim 4] The polycarbonate resin composition according to any one of claims 1 to 3, wherein said polycaprolactone (C) is a polymer of ε-caprolactone.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention] The present invention relates to a polycarbonate resin composition. More particularly, the present invention is concerned with a polycarbonate resin composition having good transparency and excellent sliding properties.

[0002]

[Prior Art] Conventionally, a polycarbonate resin has excellent transparency, heat resistance and impact resistance, so that it is widely used as a material for molding, such as injection molding, compression molding, extrusion molding, blow

molding or the like. Recently, an attempt has been made to use a polycarbonate resin as a material for forming a part of each of articles which part requires a sliding property. However, when the conventional polycarbonate resin is used in such a part, the sliding property is unsatisfactory. Unexamined Japanese Patent Application Laid-Open Specification No. Sho 50-101441 discloses a polycarbonate composition in which a lubricant oil is blended with a polycarbonate resin in order to improve sliding properties of the polycarbonate resin. The final shaped article produced from the above-mentioned polycarbonate resin composition has a sliding property. However, such shaped article is opaque. Examined Japanese Patent Application Publication Nos. Sho 59-39449 and Hei 1-40856 disclose a polycarbonate resin composition in which a specific polyorganosiloxane having a phenyl group is blended with a polycarbonate resin in order to improve the sliding properties of the polycarbonate resin while maintaining the transparency of the polycarbonate resin. However, when a shaped article is produced from the polycarbonate resin composition, the shaped article suffers white turbidity, so that a satisfactory transparency of the shaped article cannot be achieved.

[0003]

[Problems to be solved by the invention] An object of the pres·nt invention is to provide a polycarbonate resin composition having excellent sliding properties without a sacrifice of

impairing good transparency which a polycarbonate resin inherently possesses.

[0004] The present inventors have made extensive and intensive studies toward solving the above-mentioned problems. As a result, the present inventors have found that when a polycarbonate resin is blended with a specific silicone oil and a specific amount of polycaprolactone, a polycarbonate resin having improved sliding properties can be obtained without sacrifice of impairing good transparency which a polycarbonate resin inherently possesses. The present invention has been completed, based on this finding.

[0005]

[Means to solve the problem] That is, the present invention is directed to a polycarbonate resin composition comprising: (A) 95.0 to 99.9 % by weight of a polycarbonate resin, (B) 0.1 to 5.0 % by weight of a phenyl group-containing silicone oil having a refractive index (nd) of 1.42 to 1.58, wherein the total amount of components (A) and (B) is 100 % by weight, and (C) 1 to 10 parts by weight, relative to 100 parts by weight of the total amount of the components (A) and (B), of polycaprolactone.

[0006] The polycarbonate resin, which is component (A) used in the present invention, is an aromatic polycarbonate resin obtained by reacting a dihydric phenol with a carbonate precursor. Examples of dihydric phenols include 2,2'-bis(4-

hydroxyphenyl)propane (generally called bisphenol A), 1,1'-bis(4-hydroxyphenyl)ethane, 1,1'-bis(4-hydroxyphenyl)cyclohexane, 2,2'-bis(4-hydroxy-3,5-dimethylphenyl)propane, 2,2'-bis(4-hydroxy-3,5-dibromphenyl)propane, 2,2'-bis(4-hydroxy-3-methylphenyl)propane, bis(4-hydroxyphenyl)sulfide and bis(4-hydroxyphenyl)sulfone. Preferred examples of dihydric phenols are 2,2'-bis(4-hydroxyphenyl)alkanes, such as bisphenol A, which is most preferred. As a carbonate precursor, a carbonyl halide, a carbonic ester or a haloformate is used. Examples of carbonate precursors include phosgene, diphenyl carbonate and dihaloformates of dihydric phenols. In reacting the above-mentioned dihydric phenol with a carbonate precursor to thereby produce a polycarbonate resin, if desired, a catalyst, a molecular weight modifier and antioxidant may be used. The above-mentioned dihydric phenols may be used individually or in combination. Either a branched polycarbonate resin produced by copolymerizing multifunctional aromatic compounds having three or more functional groups or a polymer mixture containing two or more polycarbonate resins may be used in the present invention.

[0007] There is no particular limitation with respect to the molecular weight of the polycarbonate resin. However, when the molecular weight is too small, the strength of the resin composition is lowered. On the other hand, the molecular weight is too large, the melt viscosity is increased, so that it becomes

difficult to mold the resin composition. Therefore, the molecular weight of the polycarbonate is generally from 10,000 to 40,000, preferably from 15,000 to 30,000 in terms of the viscosity average molecular weight. The viscosity average molecular weight (M) can be determined as follows. 0.7 g of a polycarbonate resin is dissolved in 100 ml of methylene chloride at 20 °C to obtain a solution. From the specific viscosity (η_{sp}) of the obtained solution, the viscosity average molecular weight (M) can be obtained by following formulae:

$$\eta_{sp}/C = [\eta] + 0.45 \times [\eta]^2 C$$

$$[\eta] = 1.23 \times 10^{-4} M^{0.83}$$

wherein [η] represents the intrinsic viscosity of the polycarbonate resin and C represents the polymer content which is 0.7 herein.

[0008] With respect to the essential means for producing a polycarbonate resin, a brief explanation is made. In a solution method in which phosgene is used as a carbonate precursor, the polymerization reaction is generally performed in the presence of an acid binding agent and an organic solvent. Examples of acid binding agents include hydroxides of alkali metals, such as sodium hydroxide and potassium hydroxide, and amines, such as pyridine. Examples of organic solvents include hydrocarbon halides, such as methylene chloride or chlorobenzene. For acceleration of the reaction, a catalyst, such as a tertiary amine or a quaternary ammonium salt, can be used. It is

preferred that, as a molecular weight modifier, a termination agent is used. As an example of the termination agent, it is preferred to use an alkyl group-substituted phenol, such as p-tert-butylphenol. The reaction temperature is preferably from 0 to 40 °C and the pH value during the reaction is preferably maintained at 10 or more. The reaction time is preferably from several minutes to 5 hours.

[0009] In a transesterification method (melting method) in which a carbonic diester is used as a carbonate precursor, the polymerization reaction is performed by stirring a mixture of a dihydric phenol and a carbonic diester in a predetermined ratio in the presence of an inert gas while heating and while distilling off a by-produced alcohol or phenol compound. The reaction temperature varies depending on the boiling point of the by-produced alcohol or phenol compound, but is generally selected in the range of from 120 to 300 °C. The reaction is performed under conditions wherein the reaction pressure is reduced from the initial stage of the reaction so as to distill off the by-produced alcohol or phenol compound, to thereby complete the reaction. Further, as a catalyst for accelerating the reaction, a catalyst conventionally used for esterification reaction can be used. Examples of carbonic diesters include diphenyl carbonate, dinaphthyl carbonate, dimethyl carbonate, diethyl carbonate and dibutyl carbonate. Among these carbonic diesters, diphenylcarbonate is especially preferred.

[0010] A silicone oil used as component (B) is a phenyl group-containing silicone oil. As a typical silicone, a dimethylsilicone oil can be mentioned. The dimethylsilicone oil exhibits properties such that the viscosity change with the change of the temperature is small and that is chemically stable and has high heat resistance and weatherability, so that dimethylsilicone oil is widely used as a surface lubricant, releasing agent and the like. However, with respect to the refractive index (nd), there is a large difference between polycarbonate resin and a dimethylsilicone oil. For this reason, when a dimethylsilicone oil is incorpporated into a polycarbonate resin, the resultant composition becomes opaque. The silicone oil used in the present invention is a phenyl group-containing silicone oil in which a part of methyl groups of the dimethylsilicone oil is replaced by a phenyl group or phenyl groups. The phenyl group-containing silicone oil is not only improved in a heat resistance as compared to a dimethylsilicone oil, but also caused to have no melting point, so that the low temperature properties are improved wherein the fluidity is maintained until -70 °C. The more the contents of phenyl groups, the higher the refractive index and the compatibility with an organic resin. Therefore, not only can the transparency of the polycarbonate resin be retained even when the silicone oil is incorporated thereinto, but also the dispersion of the silicone oil in a resin is improved.

[0011] The phenyl group-containing silicone oil used in the present invention has a high ratio of replacement by phenyl groups and exhibits a refractive index (nd) of from 1.42 to 1.58. In the polycarbonate resin having a phenyl group-containing silicone oil added thereto, when the refractive index (nd) of the silicone oil is less than 1.48, the resultant composition becomes opaque. The opaqueness is not improved even by the addition of polycaprolactone, which addition constitutes one feature of the present invention. As phenyl group-containing silicone oils, those which are represented by following formulae (1) to (4) are especially preferred. The recurring units of the following formulae (1), (2) and (4) may assume either a random or a block configuration.

[0012]

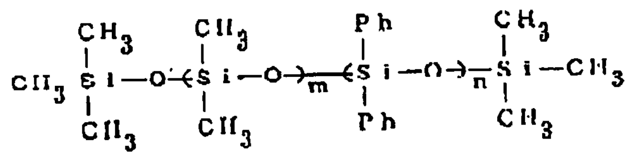
[Chemical formula 5]

$$\mathrm{CH_3}-\underset{\mathrm{CH_3}}{\overset{\mathrm{CH_3}}{\mathrm{Si}}}-\mathrm{O}-\left(\underset{\mathrm{CH_3}}{\overset{\mathrm{CH_3}}{\mathrm{Si}}}-\mathrm{O}\right)_x-\left(\underset{\mathrm{Pb}}{\overset{\mathrm{CH_3}}{\mathrm{Si}}}-\mathrm{O}\right)_y-\underset{\mathrm{CH_3}}{\overset{\mathrm{CH_3}}{\mathrm{Si}}}-\mathrm{CH_3} \qquad (1)$$

[0013] In formula (1), Ph represents a phenyl group, and x and y are integers, wherein $0 \le x \le 100$ and $0 \le y \le 100$.

[0014]

[Chemical formula 6]

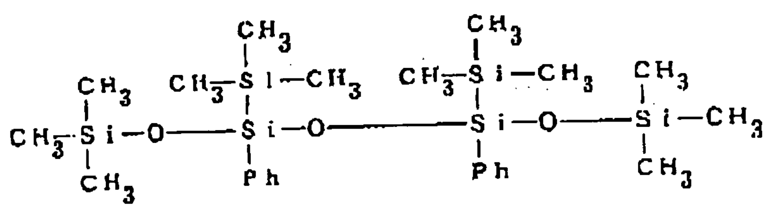


(2)

[0015] In formula (2), Ph represents a phenyl group, and m and n are integers, wherein $0 \leq m \leq 100$ and $0 \leq n \leq 100$.

[0016]

[Chemical formula 7]

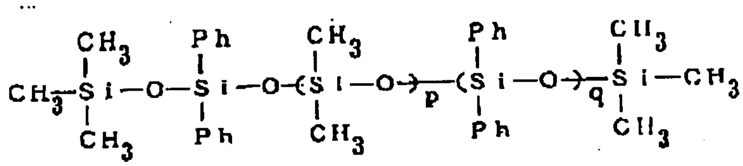


(3)

[0017] In formula (3), Ph represents a phenyl group.

[0018]

[Chemical formula 8]



(4)

[0019] In formula (4), Ph represents a phenyl group, and p and q are values such that the phenyl group content of the phenyl group-containing silicone oil represented by formula (4) is from 7 to 80 wt %. Two or more phenyl group-containing sili-

cone oils can be used in combination.

As a representative example of commercially available products of the phenyl group-containing silicone oils, SH-710 (trade name of methylphenylsilicone oil; refractive index (nd): 1.533) (manufactured and sold by Dow Corning Toray Silicone Co.,Ltd.) can be mentioned, which can be obtained easily.

[0020] Polycaprolactone used as component (c) in the present invention is a polymer of caprolactone, especially ε-caprolactone. That is, the recurring units of the Polycaprolactone are represented by following formula.

[0021]

[Chemical formula 9]

$$\left(\mathrm{CH_2-CH_2-CH_2-CH_2-CH_2-\underset{\underset{O}{\|}}{C}-O}\right)_n$$

[0022] With respect to the polycaprolactone, the hydrogen atoms of the methylene chain or the recurring units may partially be replaced by a halogen atom or a hydrocarbon group. The terminal of the polycaprolactone may be subjected to esterification or etherification. The molecular weight of the polycaprolactone is not particularly limited, but generally, the molecular weight of the polycaprolactone is from 5,000 to 40,000 in terms of the number average molecular weight. The polycaprolactone can be produced by a ring-opening polymeriza-

tion reaction of caprolactone in the presence of a catalyst, such as an acid, a base or an organometallic compound. As the commercially available of a polycaprolactone, Placcel H-1 (trade name of polycaprolactone; number average molecular weight: 10,000) (manufactured and sold by Daicel chemical Industries Ltd.) can be mentioned.

[0023] The ratio of the phenyl group-containing silicone oil (B) in the polycarbonate resin composition is 0.1 to 5.0 wt%, preferably 0.5 to 1.0 wt%, based on the total weight of the polycarbonate resin (A) and the silicone oil (B). When the ratio of the silicone oil (B) is less than 0.1 % by weight, the sliding properties of the shaped article become unsatisfactory. On the other hand, when the ratio of the silicone oil (B) is higher than 5.0 % by weight, the transparency of the shaped article becomes unsatisfactory. The amount of the polycaprolactone (C) is from 1 to 10 parts by weight, preferably from 2 to 10.0 parts by weight, relative to 100 parts by weight of the total amount of the polycarbonate resin (A) and the silicone oil (B). When the amount of the polycaprolactone (C) is less than 1 part by weight, the transparency of the obtained shaped article is unsatisfactory. When the amount of the polycaprolactone (C) is more than 10 parts by weight, the mechanical stregth and thermal charactristics (such as deflection temperature under load) of the obtained shaped article become lowered.

[0024] Into the polycarbonate resin composition of the present invention, an additive may be blended in an effective amount so far as the objects of the present invention are not impaired. Examples of additives include stabilizing agents, such as phosphoric esters and phosphorous esters; releasing agents; UV light absorbers, such as hindered phenolic compounds; and flame retardants, such as bromobisphenol and bromopolycarbonate.

mean particular*

means trivalent

[0025] A method for producing a polycarbonate resin composition of the present invention is not specifically limited. As examples of production methods, there can be mentioned a method in which polycarbonate resin (A), a phenyl group-containing silicone oil (B), a polycaprolactone (C) and, if desired, an additive are thoroughly mixed simultaneously or in a desired order by a twin-shell blender or the like, followed by palletization by means of a vent type twin-screw extruder or the like.

[0026]

[Mode for Carrying out the Invention] Hereinbelow, the present invention will be described in more detail with reference to the following Examples. The part and percent in Examples are shown by weight. The properties of the polycarbonate resin composition were evaluated as follows.

1. Dynamical friction; a dynamical friction of the shaped article was measured using a surface tester (Heidon-14). Measurement conditions are described below.

size of test specimen:	45 mm × 50 mm × 2 mm
traveling speed of test specimen:	100 mm/min
diameter of ball indentater:	10 mm
material of ball indentater:	steel
load:	200 g

2. Light transmission; the light transmission of the shaped article was measured using a reflectance and transmittance meter (HR-100, manufactured and sold by Murakami Color Research Laboratory) in accordance with ASTM D-1003. A test specimen having the same size as used for measuring the dynamical friction was used in the measurement.

[0027]

[Examples 1 to 3 and Comparative examples 1 to 6] A polycarbonate (A) resin, a silicone oil (B) and a polycaprolactone (C) were blended in accordance with the formulations shown in Table 1 and the resultant mixtures were individually melted and kneaded using a vent type twin-screw extruder (TEX-30XSST, manufactured and sold by JSW Co., Ltd) having a cylinder temperature of 270 °C followed by pelletization by means of a strand cutter. The resultant pelletized compositions were individually dried in an oven with internal air circulation at 120 °C for 5 hours. The resultant dried pellets were individually subjected to injection molding using an injection molding machine (SG-150U, manufactured and sold by Sumitomo Heavy Industries, Ltd.)(cylinder temperature: 280 °C; mold temperature:

80 °C), thereby obtaining a test specimen having a size of 45 mm × 50 mm × 2 mm. Using the test specimens obtained, dynamical friction and light transmission were measured and evaluated. The results are shown in Table 1. Component materials used in Examples and Comparative examples described in Table 1 are described below.

(A) PC; polycarbonate resin having the viscosity average molecular weight of 22,400 (manufactured and sold by Teijin·Kasei CO., Ltd.)

(B) oil A; methylphenylsilicone oil having a refractive index (nd) of 1.553 (SH710, manufactured and sold by Dow Corning Toray Silicone Co.,Ltd.)

(B) oil B; dimethylsilicone oil having a refractive index (nd) of 1.404 (SH200, manufactured and sold by Dow Corning Toray Silicone Co.,Ltd.)

(C) PCL; polycaprolactone having a number average molecular weight of 10,000 (Placcel H-1, manufactured and sold by Daicel Chemical Industries Ltd.)

[0028]

[Table 1]

	Examples			Comparative Examples					
	1	2	3	1	2	3	4	5	6
(A) PC (%)	99.5	99.5	99.0	100.0	99.0	94.0	99.5	99.0	99.0
(B) oil A (%)	0.5	0.5	1.0	-	1.0	6.0	-	-	-
(B) oil B (%)	-	-	-	-	-	-	0.5	1.0	1.0
(A) + (B) (part)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
PCL (part)	3.0	6.0	6.0	-	-	-	-	-	6.0
Light transmission (%)	90.0	91.0	90.0	92.0	75.0	45.0	47.0	38.0	40.0
Dynamical friction (gf)	78.0	77.0	70.0	130.0	70.0	47.0	65.0	31.0	30.0

[0029]

[Effects of the invention] As shown in Table 1, it is apparent that the polycarbonate resin composition of the present invention has excellent sliding properties without a sacrifice of impairing good transparency which a polycarbonate resin inherently possesses. The polycarbonate resin composition of the present invention makes it possible to develop application fields in which a polycarbonate resin has not been applied and the commercial effects of the present invention are remarkable.